Exhibit 2

US7548945B2	Specification Support	F5 Networks BIG-IP DNS (The accused product)
12Pre. A method comprising: **12a.** designating one network device, among a plurality of network devices grouped in a cluster, as a master device, wherein the master device is assigned an internet protocol (IP) address corresponding to an IP address of an authoritative domain name server;	**One network device in the cluster may be designated as a master device. See block 52. The designated master device would typically be assigned the IP address of the authoritative domain name server, in addition to the master device's device IP address.** [Col. 7, Line 32-36] **The ANS contains the IP address(es) of the host device(s) provided by the domain owner to supply information or provide services.** These host devices may be, for example, web servers, mail servers, or VPN	The accused product practices a method of designating one network device, among a plurality of network devices grouped in a cluster, as a master device, wherein the master device is assigned an internet protocol (IP) address corresponding to an IP address of an authoritative domain name server; F5 Networks, Inc. specializes in application services and application delivery networking (ADN). F5 technologies focus on the delivery, security, performance, and availability of web applications, including the availability of computing, storage, and network resources. F5 Networks provides BIG-IP products. F5's BIG-IP is a family of products covering software and hardware designed around application availability, access control, and security solutions. F5 BIG-IP DNS distributes DNS and user application requests based on business policies, data center, and cloud service conditions, user location, and application performance. See Fig. 1 **Citation 1: F5 BIG-IP DNS** F5® BIG-IP® DNS distributes DNS and user application requests based on business policies, data center and cloud service conditions, user location, and application performance. The BIG-IP platform delivers F5's high-performance DNS services with visibility, reporting, and analysis; hyperscales and secures DNS responses geographically to survive DDoS attacks; delivers a real-time DNSSEC solution; and ensures high availability of global applications in all cloud environments. **Fig. 1** Source: https://www.f5.com/pdf/products/big-ip-dns-datasheet.pdf, Page 1, last accessed May 8,

Exhibit 2
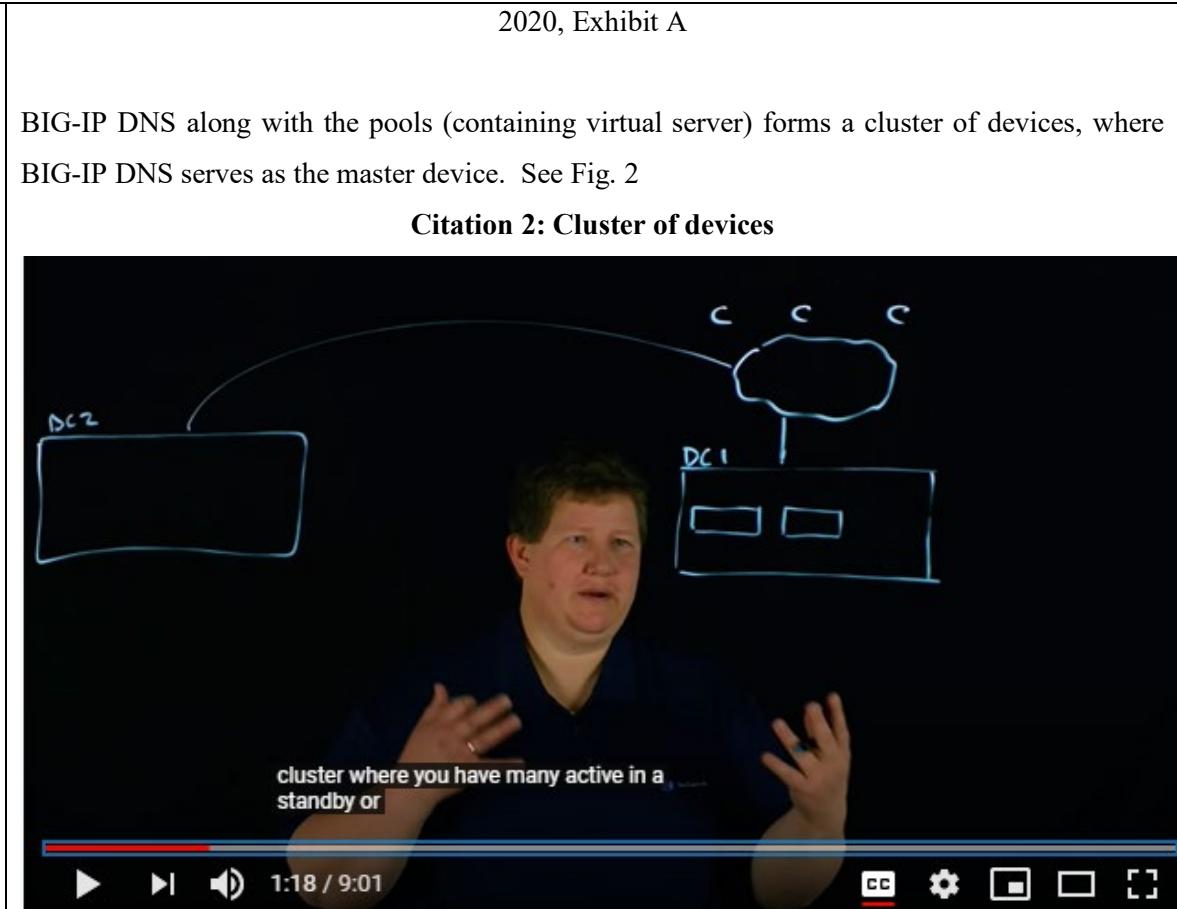
	(virtual private network) gateways. [Col. 1, Line. 43-47]	2020, Exhibit A BIG-IP DNS along with the pools (containing virtual server) forms a cluster of devices, where BIG-IP DNS serves as the master device. See Fig. 2
		Citation 2: Cluster of devices
		Fig. 2 Source: https://www.youtube.com/watch?v=9fooqDbwJIk, 1:18/9:01, last accessed May 8, 2020, Exhibit B BIG-IP DNS includes several traffic distribution capabilities based on different load balancing methods. See Fig. 3

Exhibit 2

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Citation 3: Global load balancing

Advanced global load balancing

BIG-IP DNS includes the industry's most advanced traffic distribution capabilities to match the needs of any organization or globally deployed application.

- Round robin
- Global availability
- LDNS persistence
- Application availability
- Geography
- Virtual server capacity
- Least connections
- Packets per second

- Round trip time
- Hops
- Packet completion rate
- User-defined QoS
- Dynamic ratio
- LDNS
- Ratio
- Kilobytes per second

Fig. 3

Source: https://www.f5.com/pdf/products/big-ip-dns-datasheet.pdf, Page 6, last accessed May 8, 2020, Exhibit A

BIG-IP DNS acts as an authoritative domain name server. See Fig. 4

Citation 4: BIG-IP DNS as Authoritative domain name servers

BIG-IP DNS listeners

A listener is a specialized virtual server that provides DNS services on port 53 and at the IP address assigned to the listener. When a DNS query is sent to the listener, BIG-IP DNS either handles the request locally or forwards the request to the appropriate resource.

BIG-IP DNS responds to DNS queries on a per-listener basis. The number of listeners created depends on the network configuration and the destinations to which specific queries are to be sent. For example, a single BIG-IP DNS can be the primary authoritative server for one domain, while forwarding other DNS queries to a different DNS server. BIG-IP DNS always manages and responds to DNS queries for the wide IPs that are configured on the system.

Fig. 4

Source: https://support.f5.com/csp/article/K55502976, Page 4-5, Last accessed May 8, 2020, Exhibit C
</td>
</tr>
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Exhibit 2

| 12b. communicating status information from each network device to at least the master device in the cluster; | The master device would typically **receive status information from each network device in the cluster**. See block 54. As discussed above, the status information may include the presence of the network device on the network, the network device's current load percentage, the number of active connections being supported by the network device, and the network device's IP address. [Col. 7, Line 42-48] | The accused product practices a method of communicating status information from each network device to at least the master device in the cluster. F5 BIG-IP DNS monitors the health of DNS servers to reconfigure for optimal responses. See **Fig. 5**

Citation 5: DNS Health Monitor

DNS health monitor

Detect whether DNS servers are operating at peak performance to help reconfigure for optimal responses.

Fig. 5
Source: https://www.f5.com/products/dns-delivery, Page 2, Last accessed May 8, 2020, Exhibit D

BIG-IP DNS provides tiered global server load balancing. BIG-IP DNS distributes DNS name resolution requests, first to the best available pool, and then to the best available virtual server within that pool. BIG-IP DNS selects the best available resource using either a static or a |

Exhibit 2

dynamic load balancing method. Using a dynamic load balancing method, BIG-IP DNS selects a resource based on current performance metrics collected by the big3d agents running in each data center. Therefore, the BIG-IP DNS receives status information from each network device (virtual servers). See Fig. 6 & Fig. 7

Citation 6: Global server load balancing

About global server load balancing

BIG-IP® DNS provides tiered global server load balancing (GSLB). BIG-IP DNS distributes DNS na
resolution requests, first to the best available pool in a wide IP, and then to the best available virtual s
within that pool. BIG-IP DNS selects the best available resource using either a static or a dynamic loa
balancing method. Using a static load balancing method, BIG-IP DNS selects a resource based on a
pre-defined pattern. Using a dynamic load balancing method, BIG-IP DNS selects a resource based o
current performance metrics collected by the big3d agents running in each data center.

Fig. 6

Source: BIG-IP DNS Load Balancing, Page 5, last accessed May 8, 2020, Exhibit E

Citation 7: Dynamic load balancing methods available in BIG-IP DNS

This table describes the dynamic load balancing methods available in BIG-IP® DNS.

Name	Description	Wide IP load balancing	Preferred method	Alternate method	Fallback method
Completion Rate	BIG-IP® DNS distributes DNS name resolution requests to the virtual server that currently maintains the least number of dropped or timed-out packets during a transaction between a data center and the client's LDNS.	No	Yes	No	Yes
CPU	BIG-IP DNS distributes DNS name resolution requests to the virtual server that currently has the most CPU processing time available.	No	Yes	No	Yes

Exhibit 2

Name	Description	Wide IP load balancing	Preferred method	Alternate method
	BIG-IP DNS uses the traceroute utility to track the number of router hops between a client's LDNS and each data center.			
Kilobytes/Second	BIG-IP DNS distributes DNS name resolution requests to the virtual server that is currently processing the fewest number of kilobytes per second. Use **Kilobytes/Second** only with virtual servers for which BIG-IP DNS can collect the kilobytes per second metric.	No	Yes	No
Least Connections	BIG-IP DNS distributes DNS name resolution requests to virtual servers on BIG-IP® Local Traffic Manager™ (LTM®) that currently hosts the fewest connections. Use **Least Connections** only with LTM servers.	No	Yes	No
Virtual Server Score	BIG-IP DNS distributes DNS name resolution requests to virtual servers on LTM based on a user-defined ranking. Use **Virtual Server Score** only with LTM systems on which you have assigned scores to each virtual server.	No	Yes	Yes
Virtual Server Capacity	BIG-IP DNS distributes DNS name resolution requests to virtual servers in a list that are weighted by the number of available virtual servers in the pool. Use **Virtual Server Capacity** for load balancing virtual servers managed by LTM Systems. BIG-IP DNS selects a virtual server that has the most available (UP) members. When selecting a virtual server from a wide IP pool and two or more virtual servers result in equal scores, BIG-IP DNS will return one of the equal scored virtual servers randomly.	No	Yes	Yes

Fig. 7

Source: <u>BIG-IP DNS Load Balancing</u>, Page 5-6, last accessed May 8, 2020, Exhibit E

Exhibit 2
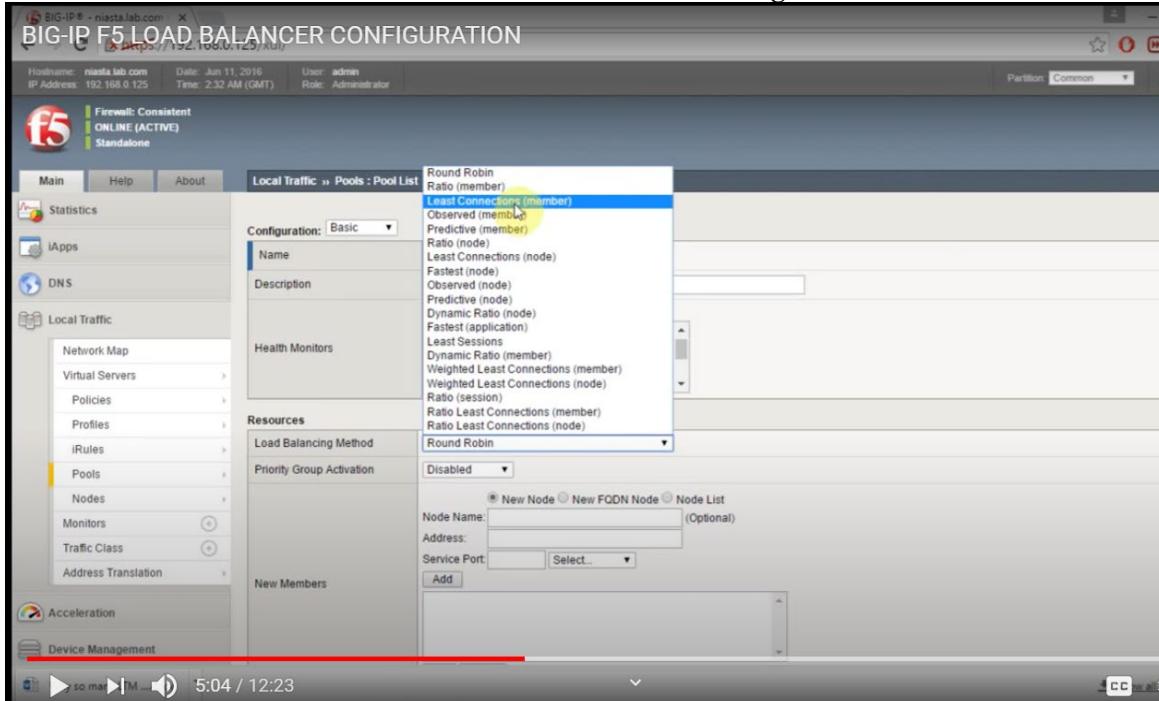
|		
		Any load balancing methods from the available methods can be applied within a pool of virtual servers. See Fig. 8 **Citation 8: BIG-IP Load balancer configuration** **Fig. 8** Source: https://www.youtube.com/watch?v=UufRG2eeFmQ, 5:04/12:23, Last accessed May 8, 2020, Exhibit F
12c. receiving a domain name service (DNS) query based upon a client request;	**Domain name service (DNS)** is used to associate Internet domain names, such as www.xyznews.com, with	The accused product practices a method of receiving a domain name service (DNS) query based upon a client request. BIG-IP DNS provides tiered global server load balancing. BIG-IP DNS distributes DNS name resolution requests (i.e. received domain name service (DNS) query based upon a client request),

Exhibit 2

<table>
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<td>an IP address. DNS allows users (clients) to access other devices (hosts) connected to the Internet by using easily remembered domain names rather than IP addresses.
[Col. 1, Line 31-35]

Because the master device would typically be assigned the IP address of the authoritative domain name server, the master device would receive any DNS queries for that domain.
[Col. 7, Line 55-58]</td>
<td>first to the best available pool, and then to the best available virtual server within that pool. BIG-IP DNS selects the best available resource using either a static or a dynamic load balancing method. Using a dynamic load balancing method, BIG-IP DNS selects a resource based on current performance metrics collected by the big3d agents running in each data center. Therefore, the BIG-IP DNS receives status information from each network device (virtual servers). See Fig. 9

Citation 9: Global server load balancing

About global server load balancing

BIG-IP® DNS provides tiered global server load balancing (GSLB). BIG-IP DNS distributes DNS na resolution requests, first to the best available pool in a wide IP, and then to the best available virtual s within that pool. BIG-IP DNS selects the best available resource using either a static or a dynamic loa balancing method. Using a static load balancing method, BIG-IP DNS selects a resource based on a pre-defined pattern. Using a dynamic load balancing method, BIG-IP DNS selects a resource based o current performance metrics collected by the big3d agents running in each data center.

Fig. 9
Source: <ins>BIG-IP DNS Load Balancing</ins>, Page 5, last accessed May 8, 2020, Exhibit E</td>
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<td>**12d.** selecting one of the network devices to communicate with the client, based on the status information of each of the</td>
<td>The master device would typically select one of the network devices in the cluster to communicate with a client in response</td>
<td>The accused product practices a method of selecting one of the network devices to communicate with the client, based on the status information of each of the network devices.

F5 BIG-IP DNS monitors the health of DNS servers to reconfigure for optimal responses. See Fig. 10</td>
</tr>
</table>

Exhibit 2

| network devices; and | to the DNS query. See block 58. **The master device would typically use the status information to select one of the network devices** such that the load of the network devices is balanced.

[Col. 7, Line 58-63] | **Citation 10: DNS Health Monitor**

Fig. 10

Source: https://www.f5.com/products/dns-delivery, Page 2, Last accessed May 8, 2020, Exhibit D

BIG-IP DNS provides tiered global server load balancing. BIG-IP DNS distributes DNS name resolution requests, first to the best available pool, and then to the best available virtual server within that pool. BIG-IP DNS selects the best available resource using either a static or a dynamic load balancing method. Using a dynamic load balancing method, BIG-IP DNS selects a resource based on current performance metrics collected by the big3d agents running in each data center (i.e. selecting one of the network devices to communicate with the client, based on the status information of each of the network devices). Therefore, the BIG-IP DNS receives |

Exhibit 2

status information from each network device (virtual servers). See Fig. 11 & Fig. 12

Citation 11: Global server load balancing

About global server load balancing

BIG-IP® DNS provides tiered global server load balancing (GSLB). BIG-IP DNS distributes DNS na
resolution requests, first to the best available pool in a wide IP, and then to the best available virtual s
within that pool. BIG-IP DNS selects the best available resource using either a static or a dynamic lo
balancing method. Using a static load balancing method, BIG-IP DNS selects a resource based on a
pre-defined pattern. Using a dynamic load balancing method, BIG-IP DNS selects a resource based o
current performance metrics collected by the `big3d` agents running in each data center.

Fig. 11

Source: [BIG-IP DNS Load Balancing](), Page 5, last accessed May 8, 2020, Exhibit E

Citation 12: Dynamic load balancing methods available in BIG-IP DNS

This table describes the dynamic load balancing methods available in BIG-IP® DNS.

Name	Description	Wide IP load balancing	Preferred method	Alternate method	Fa me
Completion Rate	BIG-IP® DNS distributes DNS name resolution requests to the virtual server that currently maintains the least number of dropped or timed-out packets during a transaction between a data center and the client's LDNS.	No	Yes	No	Yes
CPU	BIG-IP DNS distributes DNS name resolution requests to the virtual server that currently has the most CPU processing time available.	No	Yes	No	Yes

Exhibit 2

Name	Description	Wide IP load balancing	Preferred method	Alternate method
	BIG-IP DNS uses the traceroute utility to track the number of router hops between a client's LDNS and each data center.			
Kilobytes/Second	BIG-IP DNS distributes DNS name resolution requests to the virtual server that is currently processing the fewest number of kilobytes per second. Use **Kilobytes/Second** only with virtual servers for which BIG-IP DNS can collect the kilobytes per second metric.	No	Yes	No
Least Connections	BIG-IP DNS distributes DNS name resolution requests to virtual servers on BIG-IP® Local Traffic Manager™ (LTM®) that currently hosts the fewest connections. Use **Least Connections** only with LTM servers.	No	Yes	No
Virtual Server Score	BIG-IP DNS distributes DNS name resolution requests to virtual servers on LTM based on a user-defined ranking. Use **Virtual Server Score** only with LTM systems on which you have assigned scores to each virtual server.	No	Yes	Yes
Virtual Server Capacity	BIG-IP DNS distributes DNS name resolution requests to virtual servers in a list that are weighted by the number of available virtual servers in the pool. Use **Virtual Server Capacity** for load balancing virtual servers managed by LTM Systems. BIG-IP DNS selects a virtual server that has the most available (UP) members. When selecting a virtual server from a wide IP pool and two or more virtual servers result in equal scores, BIG-IP DNS will return one of the equal scored virtual servers randomly.	No	Yes	Yes

Fig. 12

Source: BIG-IP DNS Load Balancing, Page 5-6, last accessed May 8, 2020, Exhibit E
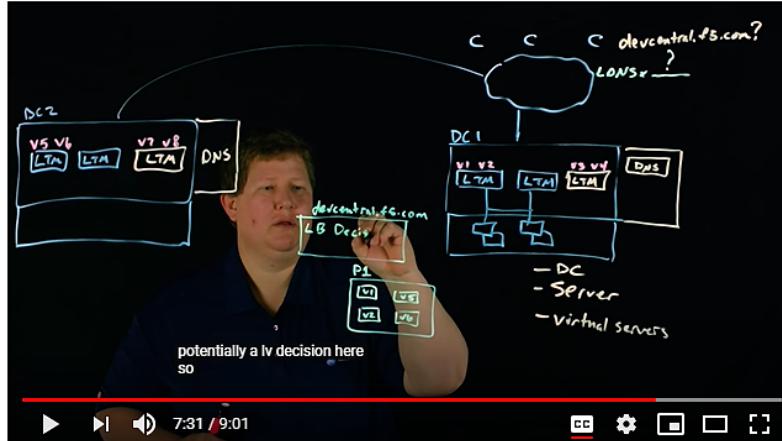
Exhibit 2

<table>
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<div align="center">Citation 13: Load balancing decision</div>

<div align="center">Fig. 13
Source: https://www.youtube.com/watch?v=9fooqDbwJIk, 7:31/9:01, last accessed May 8, 2020,
Exhibit B</div>
</td>
</tr>
<tr>
<td>12e. returning a device IP address of the selected one of the network devices in response to the DNS query.</td>
<td>The IP address of the selected network device would be returned by the master device to the client, via the ISP name server.
[Col. 8, Line 2-4]</td>
<td>The accused product practices a method of returning a device IP address of the selected one of the network devices in response to the DNS query.

Using a dynamic load balancing method, BIG-IP DNS selects a resource based on current performance metrics collected by the big3d agents running in each data center. Therefore, a device IP address of the selected resource (selected virtual server in the selected pool) is returned to the client. See Fig. 14</td>
</tr>
</table>

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Exhibit 2

		Citation 14: Global server load balancing **About global server load balancing** BIG-IP® DNS provides tiered global server load balancing (GSLB). BIG-IP DNS distributes DNS name resolution requests, first to the best available pool in a wide IP, and then to the best available virtual server within that pool. BIG-IP DNS selects the best available resource using either a static or a dynamic load balancing method. Using a static load balancing method, BIG-IP DNS selects a resource based on a pre-defined pattern. Using a dynamic load balancing method, BIG-IP DNS selects a resource based on current performance metrics collected by the `big3d` agents running in each data center. **Fig. 14** Source: BIG-IP DNS Load Balancing, Page 5, last accessed May 8, 2020, Exhibit E **Citation 15: BIG-IP DNS responds to the client query**

Exhibit 2

Fig. 15
Source: https://www.youtube.com/watch?v=9fooqDbwJIk, 4:55/9:01, last accessed May 8, 2020,

Exhibit B

The preferred load balancing method BIG-IP DNS uses to return the IP address of a virtual server in response to a DNS name resolution request (i.e. returning a device IP address of the selected one of the network devices in response to the DNS query). See Fig. 16

Citation 16: Preferred load balancing method

Exhibit 2

Fig. 16
Source: BIG-IP DNS Load Balancing, Page 12, last accessed May 8, 2020, Exhibit E

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Exhibit 2

References Cited

Exhibit(s)	Description	Link
Exhibit A	F5 Networks BIG-IP DNS Datasheet	https://www.f5.com/pdf/products/big-ip-dns-datasheet.pdf
Exhibit B	*Video* - BIG-IP DNS Load Balancing Introduction	https://www.youtube.com/watch?v=9fooqDbwJIk
Exhibit C	BIG-IP LTM-DNS operations guide	https://support.f5.com/csp/article/K55502976
Exhibit D	BIG-IP DNS Delivery	https://www.f5.com/products/dns-delivery
Exhibit E	BIG-IP DNS Load Balancing	BIG-IP DNS Load Balancing
Exhibit F	*Video* - BIG-IP Load Balancer Configuration	https://www.youtube.com/watch?v=UufRG2eeFmQ